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VERIFICATION

I, Masayuki IKEMURA, declare and say:

that I am thoroughly conversant in both the Japanese and English languages;

that I am presently engaged as a translator in these languages;

that the attached document represents a true and accurate English translation of the Japanese Patent Application No. 2002-333717 entitled "LEADFRAME, METHOD FOR MANUFACTURING SEMICONDUCTOR DEVICE USING THE SAME, SEMICONDUCTOR DEVIE USING THE SAME, AND ELECTRONIC EQUIPMENT".

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 21st day of February, 2006

Masayuki Ikemura

Masayuki IKEMURA

[Document Name]	Request for Patent
[File Number]	02J02628
[Date of Filing]	November 18, 2002
[Addressee]	Commissioner of the Patent Office
[IPC]	H01L 23/50

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[Indication of Official Fee]

[Deposit No.] 009092

[Paid Amount] ¥21,000

[List of Documents]

[Document Name] Specification 1

[Document Name] Drawings 1

[Document Name] Abstract 1

[Proof] Requested

[Document Name] Specification

[Title of the Invention] LEADFRAME, METHOD FOR MANUFACTURING SEMICONDUCTOR DEVICE USING THE SAME, SEMICONDUCTOR DEVICE USING THE SAME, AND ELECTRONIC EQUIPMENT

[Scope of the Claims]

[Claim 1] A leadframe to be used in a semiconductor device,

which comprises a plurality of parallel first leads and a plurality of parallel second leads,

wherein the pitch of the first leads is different from that of the second leads, and the first leads are joined end-to-end with the second leads.

[Claim 2] The leadframe according to claim 1,

wherein at least either of the first leads or the second leads have their thickness reduced.

[Claim 3] A method for manufacturing a semiconductor device using a leadframe,

which comprises the steps of mounting a semiconductor element on the leadframe according to claim 1, and encapsulating the semiconductor element in a package,

wherein the dimension of the package for en-

capsulation is set such that at least either of the first leads or the second leads project from the package.

[Claim 4] The method for manufacturing a semiconductor device using a leadframe, according to claim 3,

wherein at least either of the first leads or the second leads are squeezed by a mold for molding the package and have their thickness reduced.

[Claim 5] A semiconductor device using the leadframe according to claim 1.

[Claim 6] An electronic equipment using the semiconductor device according to claim 5.

[Detailed Description of the Invention]

[0001]

[Technical Field to which the Invention Belongs]

The present invention relates to leadframes, a method for manufacturing semiconductor devices using the same, semiconductor devices using the same, and electronic equipments.

[0002]

[CONVENTIONAL ART]

Leadframes for semiconductor devices include many

variations such as for DIP (Dual Inline Package) packages and SOP (Small Outline Package) packages (see Patent Document 1). A leadframe for DIP packages has leads to be inserted into holes in a substrate, these leads having a thickness of 0.25 mm at the tips and being spaced at a pitch of 2.54 mm. A leadframe for SOP packages has leads to be placed on a substrate surface, these leads having a thickness of about 0.15 to 0.20 mm at the tips and being spaced at a pitch of 1.27 mm.

[0003] Figs. 4(a) and 4(b) are a sectional view and a plan view of a photocoupling element using a conventional leadframe for DIP packages. Fig. 5 is a flowchart which describes a process of manufacturing this photocoupling element.

[0004] In a conventional photocoupling element 101, a light-emitting element 102 and a light-receiving element 103 are respectively mounted on and die bonded to headers 104a, 105a of the leadframes 104, 105. The light-emitting element 102 and the light-receiving element 103 are also wire bonded to leads 104b, 105b of the leadframes 104, 105 by wires 106, 107, respectively. Then, for relaxation of stress, the light-emitting element 102 is pre-coated with a silicone resin 108. With the optical axes of the light-emitting element 102 and the light-receiving element 103 being

aligned with each other, the leadframes 104, 105 are fixed in position. Next, a transparent epoxy resin 111 for forming an optical transmission path between the light-emitting element 102 and the light-receiving element 103 is subjected to primary molding. In this state, the leadframes 104, 105 are subjected to primary tie bar cut. Thereafter, a light shading epoxy resin (package) 112 is subjected to transfer molding. This packaged item undergoes exterior plating, secondary tie bar cut for the leadframes 104, 105, lead forming (forming of the leads 104b, 105b outside the package), withstand voltage test (examination of insulation between the light-emitting element 102 and the light-receiving element 103), electric characteristics test (measurement of various electric characteristics), marking, inspection of external appearance, and packing. Finally, the photocoupling element 101 is shipped as a commercial product.

[0005] Being designed for DIP packages, the leadframes 104, 105 have their leads 104b, 105b project downwardly so as to be inserted into holes in a substrate.

[0006] Instead of transfer molding, injection molding, casting or the like can also be applied. Further, with respect to the primary molding for forming an optical transmission path between the light-emitting

element 102 and the light-receiving element 103, a transparent silicone resin may be used instead of a transparent epoxy resin.

[0007] Fig. 6 is a flowchart which describes a process of manufacturing conventional leadframes for DIP packages.

[0008] A coiled metal plate (a plate of Cu, Fe or the like), as a leadframe material, is unwound and stamped by means of a stamping die so as to form leadframes. Then, each leadframe is plated with silver at its header and at an area to be connected with the bonding wire. The header and leads of each leadframe are bent and processed into commercial products.

[0009] Depending on the situation, the stamping step, the plating step and the bending/cutting step may be performed in different orders.

[0010] Figs. 7(a) and 7(b) are a sectional view and a plan view of a photocoupling element using a conventional leadframe for SOP packages. Fig. 8 is a flowchart which describes a process of manufacturing this photocoupling element. Concerning the photo-coupling element of Figs. 7(a) and 7(b), areas which serve the same operations as those mentioned in Figs. 4(a) and 4(b) are indicated by the same reference numerals.

[0011] The only difference between the photocoupling element 101 in Figs. 4(a) and 4(b) and a photocoupling element 121 is that the latter employs leadframes 124, 125 in place of the leadframes 104, 105 of the photocoupling element 101.

[0012] Being designed for SOP packages, the leadframes 124, 125 have their leads 124b, 125b bent so as to be in contact with a wiring pattern on the substrate surface.

[0013] The manufacture process for the photocoupling element 121 shown in Fig. 8 is different from the one for the photocoupling element 101 shown in Fig. 5 in that the secondary tie bar cut step is omitted.

[0014] The leadframe for SOP packages is manufactured by the same process for the leadframe for DIP packages as described in Fig. 6.

[0015]

[Patent Document 1]

Japanese Patent Laid-open Publication No. H7-94657

[0016] Incidentally, assembly processes for electronic components are recently divided into two dominant trends. One is to promote automation by using mounters, whereas the other is to encourage manual operations which take advantage of a cheap workforce

in Asian countries, mainly in China.

[0017] The former process, in which mounters automatically mount electronic components on substrates by reflow or other manner, requires electronic components using leadframes for small SOP packages. On the other hand, the latter process, in which human workers manually insert leads of each electronic component into holes in substrates, requires electronic components using leadframes for DIP packages.

[0018] From another point of view, semiconductor devices (e.g. photocoupling element) using leadframes for DIP packages and semiconductor devices (e.g. photocoupling element) using leadframes for SOP packages have to be manufactured in separate production lines even if their electric characteristics are totally identical. Therefore, production plans for these semiconductor devices should be adjusted independently of each other, according to the market situation.

[0019] From still another point of view, leadframes for DIP packages and those for SOP packages are different in lead pitch and thickness at the lead tips, as mentioned earlier. Therefore, manufacture of these leadframes requires individual stamping dies and bending dies.

[0020] However, the proportion of semiconductor devices using leadframes for DIP packages and those using

leadframes for SOP packages demanded in the market are changing radically. Under such circumstances, setting of production plans for the respective semiconductor devices has been a difficult task. It is often the case that manufacturers may be flooded with orders beyond their production capacities or may fail to cater for unexpected orders.

[0021] Considering the situation, an object of the present invention is to provide leadframes which are adjustable to more than one types of packages.

[0022] Another object of the present invention is to provide a method for manufacturing semiconductor devices using the leadframes of the present invention, semiconductor devices using the same, and electronic equipments.

[0023]

[Means to Solve the Problems]

In order to solve the above problems, the present invention is directed to a leadframe to be used in a semiconductor device, which comprises a plurality of parallel first leads and a plurality of parallel second leads. The pitch of the first leads is different from that of the second leads, and the first leads are joined end-to-end with the second leads.

[0024] According to the thus arranged invention,

the pitch of the first leads is different from that of the second leads, and the first leads are joined end-to-end with the second leads. In the steps of mounting a semiconductor element on the leadframe and encapsulating the semiconductor element in a package, if the first leads are encapsulated in the package and only the second leads are allowed to project from the package, a semiconductor device equipped with the second leads is obtained. If both the first leads and the second leads are allowed to project from the package and the second leads are cut off later, a semiconductor device equipped with the first leads is obtained. Namely, while using a common leadframe component, it is possible to set either of two types of lead pitches. Sharing of a leadframe component decreases a material cost and material types, and also simplifies component control. In addition, a single production line can serve for two types of semiconductor devices which have different lead pitches. Sharing of a production line enables changes of production plans for the two types of semiconductor devices without difficulty, achieves stable supply of semiconductor devices and reduction of capital investment cost, and provides semiconductor devices at a lower cost.

[0025] In the present invention, at least either

of the first leads or the second leads have their thickness reduced.

[0026] As for the method for manufacturing a semiconductor device, the method according to the present invention comprises the steps of mounting a semiconductor element on the leadframe of the present invention, and encapsulating the semiconductor element in a package. In this method, the dimension of the package for encapsulation is set such that at least either of the first leads or the second leads project from the package.

[0027] The manufacture method of the present invention can also accomplish the same operations and effects as achieved by the leadframe of the present invention.

[0028] Further in the present invention, at least either of the first leads or the second leads are squeezed by a mold for molding the package and have their thickness reduced.

[0029] In the case where at least either of the first leads and the second leads are made thinner by a mold for molding the package and have their thickness reduced, there is no need to include a special step for reducing their thickness, thereby avoiding cost increase.

[0030] Furthermore, the present invention en-

compasses not only leadframes and a method for manufacturing semiconductor devices using the same, but also semiconductor devices using the same and electronic equipments.

[0031] The semiconductor devices include photocoupling elements, ICs, LSIs, and the like.

[0032] The electronic equipments include DVDs, CDs, MDs and other playback equipment, TVs, VTRs, power equipment, inverter control equipment, and the like.

[0033]

[Embodiments of the Invention]

Referring to the attached drawings, an embodiment of the present invention is hereinafter described in detail.

[0034] Figs. 1(a)-1(d) concern steps for manufacturing a photocoupling element which utilizes an embodiment of a leadframe according to the present invention. A photocoupling element 10D is composed of a light-emitting side leadframe 11 and a light-receiving side leadframe 21.

[0035] Referring to Fig. 1(a), the light-emitting side leadframe 11 has parallel first leads 12, parallel second leads 13, tie bars 14, 15 which join the first leads 12, and a header 16 provided at an end of one of the first leads 12. The first leads 12 are joined one

by one with the second leads 13.

[0036] The thickness of the light-emitting side leadframe 11 is 0.25 mm, following the DIP package specification. The pitch of the first leads 12 is set to 1.27 mm, following the SOP package specification. The pitch of the second leads 13 is set to 2.54 mm, following the DIP package specification.

[0037] As shown in Fig. 1(a), the light-receiving side leadframe 21 has parallel first leads 22, parallel second leads 23, tie bars 24, 25 which join the first leads 22, and a header 26 provided at an end of one of the first leads 22. The first leads 22 are joined one by one with the second leads 23.

[0038] Similar to the light-emitting side leadframe 11, the thickness of the light-receiving side leadframe 21 is 0.25 mm, following the DIP package specification. The pitch of the first leads 22 is set to 1.27 mm, following the SOP package specification. The pitch of the second leads 23 is set to 2.54 mm, following the DIP package specification.

[0039] The first leads 12 of the light-emitting side leadframe 11 are bent in advance as shown in Fig. 2. In this light-emitting side leadframe 11, a light-emitting element 17 is mounted and die-bonded on the header 16 which is provided at one of the first leads

12, as illustrated in Fig. 1(a). The light-emitting element 17 is further wire-bonded to the other first lead 12 via a wire 18. For the purpose of stress relaxation, the thus bonded light-emitting element 17 may be pre-coated with a silicone resin.

[0040] Likewise, the first leads 22 of the light-receiving side leadframe 21 are bent in advance as shown in Fig. 2. In this light-receiving side leadframe 21, a light-receiving element 27 is mounted and die-bonded on the header 26 which is provided at one of the first leads 22, as illustrated in Fig. 1(a). The light-receiving element 27 is further wire-bonded to the other first lead 22 via a wire 28.

[0041] Thus, the light-emitting element 17 is mounted on the light-emitting side leadframe 11, and the light-receiving element 27 is mounted on the light-receiving side leadframe 21. Then, with the optical axes of the light-emitting element 17 and the light-receiving element 27 being aligned with each other, the light-emitting side leadframe 11 and the light-receiving side leadframe 21 are fixed in position. In this state, a transparent epoxy resin 31 for forming an optical transmission path between the light-emitting element 17 and the light-receiving element 27 is subjected to primary molding.

[0042] Thereafter, the tie bar 14 of the light-emitting side leadframe 11 and the tie bar 24 of the light-receiving side leadframe 21 are cut in the manner shown in Fig. 1(b). Further, a light shading epoxy resin (package) 32 is subjected to transfer molding as shown in Fig. 1(c).

[0043] Usually, while these steps are conducted, multiple first leads 12 and multiple second leads 13 of the light-emitting side leadframe 11 are connected by the tie bars 14, 15, and multiple first leads 22 and multiple second leads 23 of the light-receiving side leadframe 21 are connected by the tie bars 24, 25. Hence, a plurality of photocoupling elements D are manufactured in one process.

[0044] Finally, the tie bar 15 of the light-emitting side leadframe 11 and the tie bar 25 of the light-receiving side leadframe 21 are cut in the manner shown in Fig. 1(d), so that the photocoupling elements D are separated one by one.

[0045] Afterwards, each of the photocoupling elements 10D undergoes lead forming (forming of the second leads 13 of the light-emitting side leadframe 11 and the second leads 23 of the light-receiving side leadframe 21), withstand voltage test (examination of insulation between the light-emitting element 17 and

the light-receiving element 27), electric characteristics test (measurement of various electric characteristics), marking, inspection of external appearance, and packing, before shipped as a commercial product. As for the lead forming, the second leads 13, 23 are formed to such a configuration that they can be inserted into holes in a substrate.

[0046] As apparent from the photocoupling element 10D in Fig. 1(d), the second leads 13 of the light-emitting side leadframe 11 and the second leads 23 of the light-receiving side leadframe 21 serve to establish external connection.

[0047] As mentioned earlier, the thickness of the light-emitting side leadframe 11 and the light-receiving side leadframe 21 is 0.25 mm, following the DIP package specification. The pitch of the second leads 13, 23 is set to 2.54 mm, following the DIP package specification.

[0048] Namely, the external connection leads in this photocoupling element 10D are made to the DIP package specification. Hence, the photocoupling element 10D can be classified into a photocoupling element using a leadframe for DIP packages.

[0049] Figs. 3(a)-3(d) concern steps for manufacturing a different photocoupling element which

utilizes a leadframe of this embodiment. In Fig. 3, areas which provide the same operations as those mentioned in Fig. 1 are indicated by the same reference numerals.

[0050] Just as the photocoupling element 10D in Fig. 1, a photocoupling element 10S is composed of a light-emitting side leadframe 11, a light-receiving side leadframe 21, a light-emitting element 17, a light-receiving element 27 and the like. In other words, the photocoupling element 10S and the photocoupling element 10D share most of the components.

[0051] Nevertheless, the photocoupling element 10S and the photocoupling element 10D require individual molds for primary molding of a transparent epoxy resin for forming an optical transmission path between the light-emitting element 17 and the light-receiving element 27, and for transfer molding of a light shading epoxy resin (package).

[0052] Referring to the photocoupling element 10S in Fig. 3(a), the light-emitting element 17 is mounted on the light-emitting side leadframe 11, and the light-receiving element 27 is mounted on the light-receiving side leadframe 21. With the optical axes of the light-emitting element 17 and the light-receiving element 27 being aligned with each other,

the light-emitting side leadframe 11 and the light-receiving side leadframe 21 are fixed in position. In this state, a transparent epoxy resin 41 for forming an optical path between the light-emitting element 17 and the light-receiving element 27 is subjected to primary molding.

[0053] During the primary molding, the first leads 12 of the light-emitting side leadframe 11 and the first leads 22 of the light-receiving side leadframe 21 are squeezed by the primary mold. As a result, the thickness of the first leads 12, 22, which is originally 0.25 mm following the DIP package specification, is reduced to about 0.15 to 0.20 mm so as to conform to the SOP package specification.

[0054] Thereafter, the tie bar 14 of the light-emitting side leadframe 11 and the tie bar 24 of the light-receiving side leadframe 21 are cut in the manner shown in Fig. 3(b). Further, a light shading epoxy resin (package) 42 is subjected to transfer molding as shown in Fig. 3(c).

[0055] Usually, while these steps are conducted, multiple first leads 12 and multiple second leads 13 of the light-emitting side leadframe 11 are connected by the tie bars 14, 15, and multiple first leads 22 and multiple second leads 23 of the light-receiving side

leadframe 21 are connected by the tie bars 24, 25. Hence, a plurality of photocoupling elements 10S are manufactured in one process.

[0056] Finally, the tie bar 15 of the light-emitting side leadframe 11 and the tie bar 25 of the light-receiving side leadframe 21 are cut in the manner shown in Fig. 3(d), so that the photocoupling elements 10S are separated one by one. The second leads 13 of the light-emitting side leadframe 11 and the second leads 23 of the light-receiving side leadframe 21 are cut at the same time.

[0057] Afterwards, each of the photocoupling elements 10S undergoes lead forming (forming of the first leads 12 of the light-emitting side leadframe 11 and the first leads 22 of the light-receiving side leadframe 21), withstand voltage test (examination of insulation between the light-emitting element 17 and the light-receiving element 27), electric characteristics test (measurement of various electric characteristics), marking, inspection of external appearance, and packing, before shipped as a commercial product. As for the lead forming, the first leads 12, 22 are formed to such a configuration that they can be mounted on a substrate surface.

[0058] As apparent from the photocoupling element

10S in Fig. 3(d), the first leads 12 of the light-emitting side leadframe 11 and the first leads 22 of the light-receiving side leadframe 21 serve to establish external connection.

[0059] As mentioned earlier, the pitch of the first leads 12 of the light-emitting side leadframe 11 and the first leads 22 of the light-receiving side leadframe 21 is set to 1.27 mm, following the SOP package specification. The thickness of the first leads 12, 22 is reduced during the primary molding step to about 0.15 to 0.20 mm, following the SOP package specification.

[0060] Namely, the external connection leads in this photocoupling element 10S are made to the SOP package specification. Hence, the photocoupling element 10S can be classified into a photocoupling element using a leadframe for SOP packages.

[0061] With use of the leadframe of this embodiment, it is possible to obtain a leadframe for DIP packages by letting the second leads 13, 23 project from the package, or to obtain a leadframe for SOP packages by cutting the second leads 13, 23 and letting the first leads 12, 22 project from the package. Hence, a leadframe for DIP packages and the one for SOP packages, which have conventionally been made from different leadframe components, can be made from one type of common

leadframe component. It is also possible to decrease a material cost and material types and to simplify component control.

[0062] Moreover, comparison between Figs. 1(a)-1(d) and Figs. 3(a)-3(d) reveals an advantage that DIP packages and SOP packages can share a production line. Therefore, it is easily possible to change production plans for the two types of photocoupling elements which are distinguished by lead pitches. Besides, it is possible to achieve stable supply of photocoupling elements and reduction of capital investment cost and also to provide photocoupling elements at a lower cost.

[0063] It should be understood that the present invention is not limited to the above embodiment but may be modified in various manners. For example, to reduce the thickness of the first leads 12, 22 in the above embodiment, the first leads are squeezed by the primary mold during the primary molding step. Instead, the first leads 12, 22 may be made thinner in advance by other known methods. In addition, the primary mold and the secondary mold may be shared in the processes of manufacturing the photocoupling element 10D and the photocoupling element 10S.

[0064] The leadframe according to the present

invention is applicable not only to photocoupling elements but also to other semiconductor devices such as ICs and LSIs. The present invention further encompasses electronic equipments which contain semiconductor devices using the leadframes. As the electronic equipments, there may be mentioned DVDs, CDs, MDs and other playback equipment, TVs, VTRs, power equipment, inverter control equipment, and the like.

[0065] According to the present invention as described above, the pitch of the first leads is different from that of the second leads, and the first leads are joined end-to-end with the second leads. In the steps of mounting a semiconductor element on the leadframe and encapsulating the semiconductor element in a package, if the first leads are encapsulated in the package and only the second leads are allowed to project from the package, a semiconductor device equipped with the second leads is obtained. If both the first leads and the second leads are allowed to project from the package and the second leads are cut off later, a semiconductor device equipped with the first leads is obtained. Namely, while using a common leadframe component, it is possible to set either of two types of lead pitches. Sharing of a leadframe component decreases a material cost and material types,

and also simplifies component control. In addition, a single production line can serve for two types of semiconductor devices which have different lead pitches. Sharing of a production line enables changes of production plans for the two types of semiconductor devices without difficulty, achieves stable supply of semiconductor devices and reduction of capital investment cost, and provides semiconductor devices at a lower cost.

[Brief Description of the Drawings]

[Fig. 1] Figs. 1(a)-1(d) concern steps for manufacturing a photocoupling element which utilizes an embodiment of a leadframe according to the present invention.

[Fig. 2] Fig. 2 is a perspective view showing a leadframe of this embodiment.

[Fig. 3] Fig. 3 concerns steps for manufacturing a different photocoupling element which utilizes a leadframe according to this embodiment.

[Fig. 4] Figs. 4(a) and 4(b) are a sectional view and a plan view of a photocoupling element using a conventional leadframe for DIP packages.

[Fig. 5] Fig. 5 is a flowchart describing a process for manufacturing a photocoupling element shown in Fig. 4.

[Fig. 6] Fig. 6 is a flowchart describing a process for manufacturing conventional leadframes for DIP packages.

[Fig. 7] Figs. 7(a) and (b) are a sectional view and a plan view of a photocoupling element using a conventional leadframe for SOP packages.

[Fig. 8] Fig. 8 is a flowchart describing a process for manufacturing a photocoupling element shown in Fig. 7.

[Description of the Numerals]

10D, 10S	photocoupling element
11	light-emitting side leadframe
12, 22	first lead
13, 23	second lead
14, 15, 24, 25	tie bar
16, 26	header
17	light-emitting element
18, 28	wire
21	light-receiving side leadframe
27	light-receiving element
31, 41	transparent epoxy resin
32, 42	light shading epoxy resin (package)

[Document Name] Abstract

[Summary]

[Problem] To provide leadframes which are adjustable to more than one types of packages.

[Solution] To obtain a leadframe for DIP packages, second leads 13, 23 are allowed to project from a package. To obtain a leadframe for SOP packages, first leads 12, 22 are allowed to project from a package, and the second leads 13, 23 are cut off. Eventually, one type of leadframe will suffice, without a need to prepare a leadframe for DIP packages and a leadframe for SOP packages independently.

[Selected Figure] Fig. 1

Fig.1

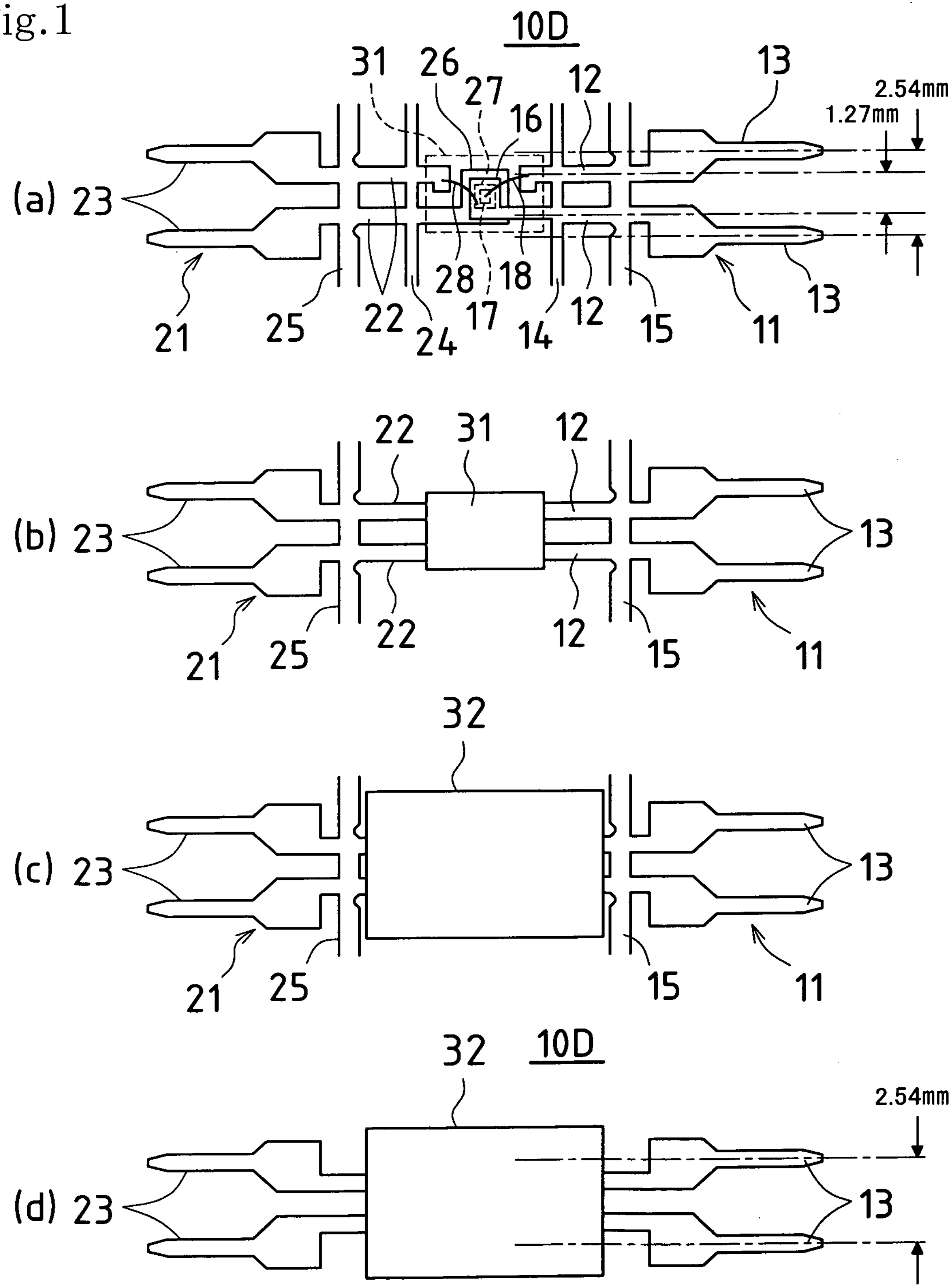

10D
31
26
27
16
12
13
2.54mm
1.27mm
(a)
23
28
18
21
25
22
24
17
14
12
15
11
13
(b)
23
22
31
12
13
21
25
22
12
15
11
32
(c)
23
13
21
25
15
11
32
10D
2.54mm
(d)
23
13

Fig.2

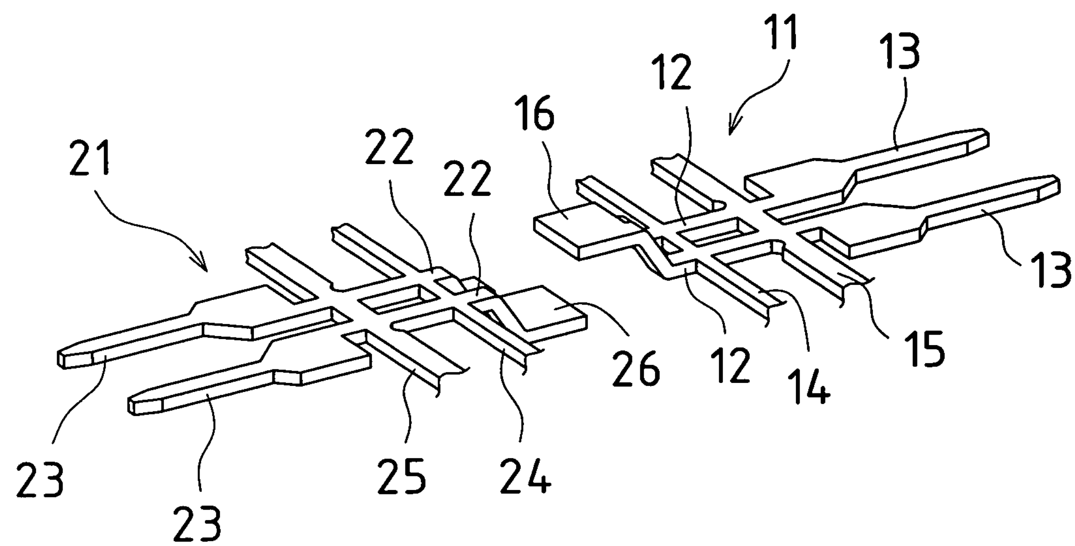


Fig.3

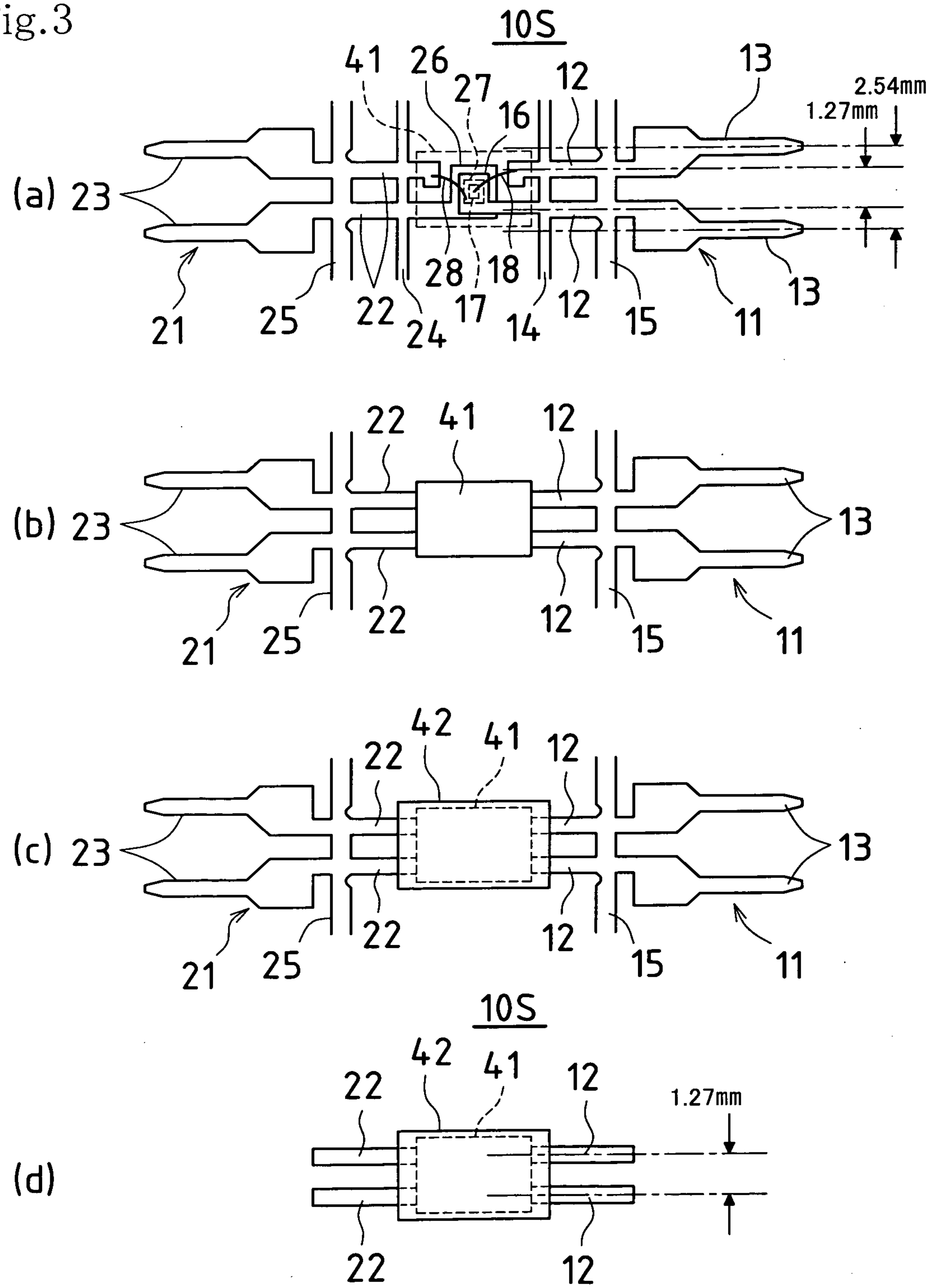
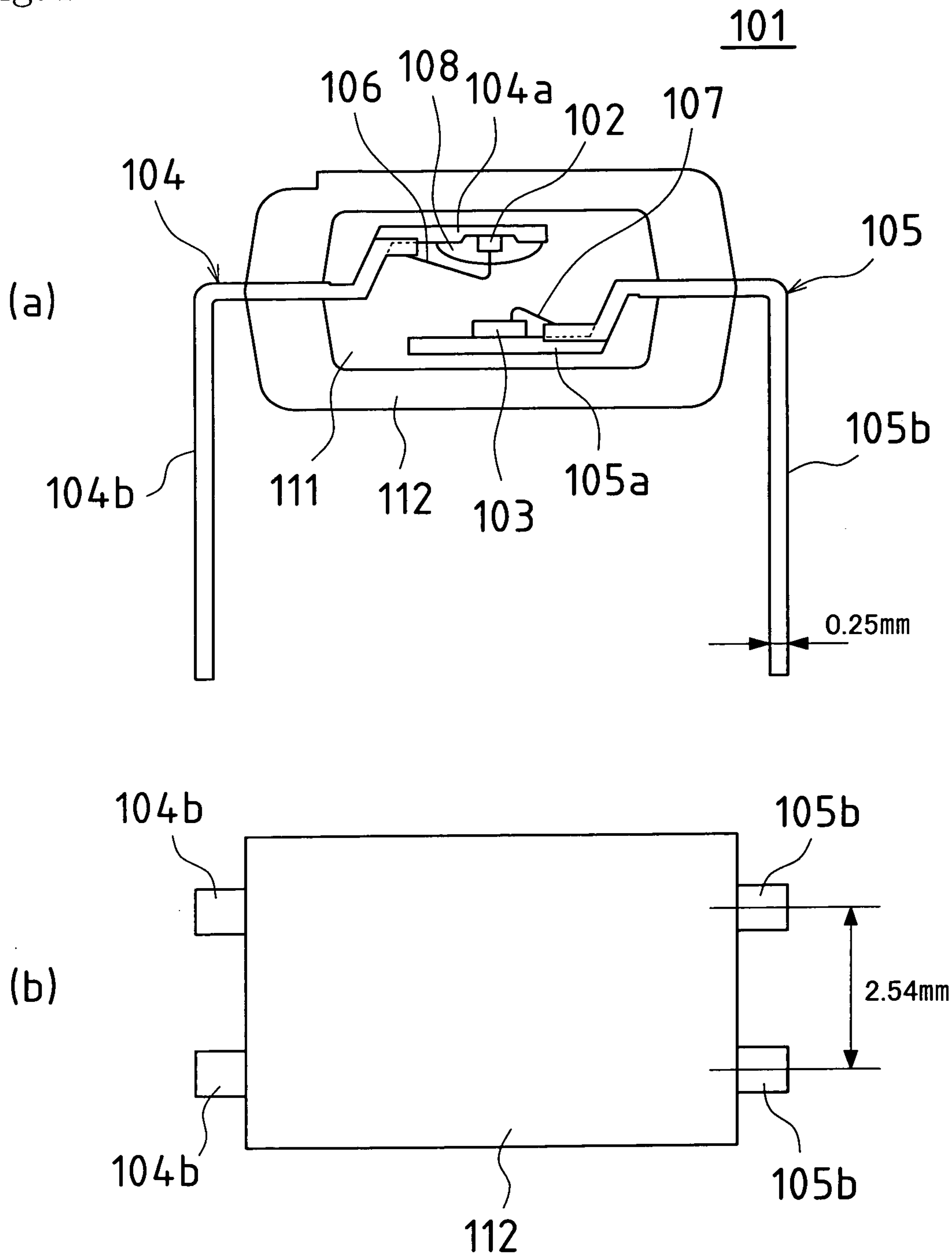

10S
(a)
41
26
27
16
12
13
2.54mm
1.27mm
23
28
18
17
21
25
22
24
14
12
15
11
13
(b)
22
41
12
23
13
21
25
22
12
15
11
(c)
42
41
22
12
23
13
21
25
22
12
15
11
10S
(d)
42
41
22
12
1.27mm
22
12

Fig.4



101
(a)
106
108
104a
102
107
104
105
105b
104b
111
112
103
105a
0.25mm
(b)
104b
105b
2.54mm
104b
105b
112

Fig.5

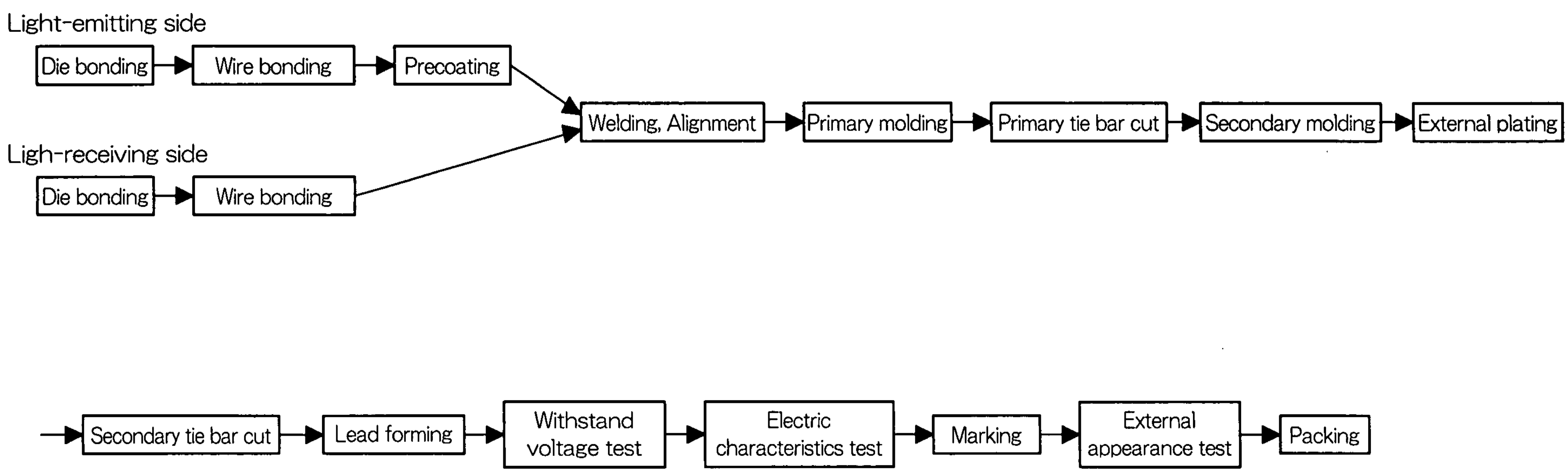

Light-emitting side
Die bonding
Wire bonding
Precoating
Ligh-receiving side
Die bonding
Wire bonding
Welding, Alignment
Primary molding
Primary tie bar cut
Secondary molding
External plating
Secondary tie bar cut
Lead forming
Withstand voltage test
Electric characteristics test
Marking
External appearance test
Packing

Fig.6

Material → Stamping step → Plating step → Bending/Cutting step → Commercial product

Stamping step	Plating step	Bending/Cutting step	Commercial product
Molding of header, lead, etc.	Plating of header on which semiconductor element is mounted. Plating of terminal at area to be subjected to wire bonding.	Bending of header. For strip-shaped product, leads are cut into given length thereafter.	· reel-shaped product · strip-shaped product

Fig.7

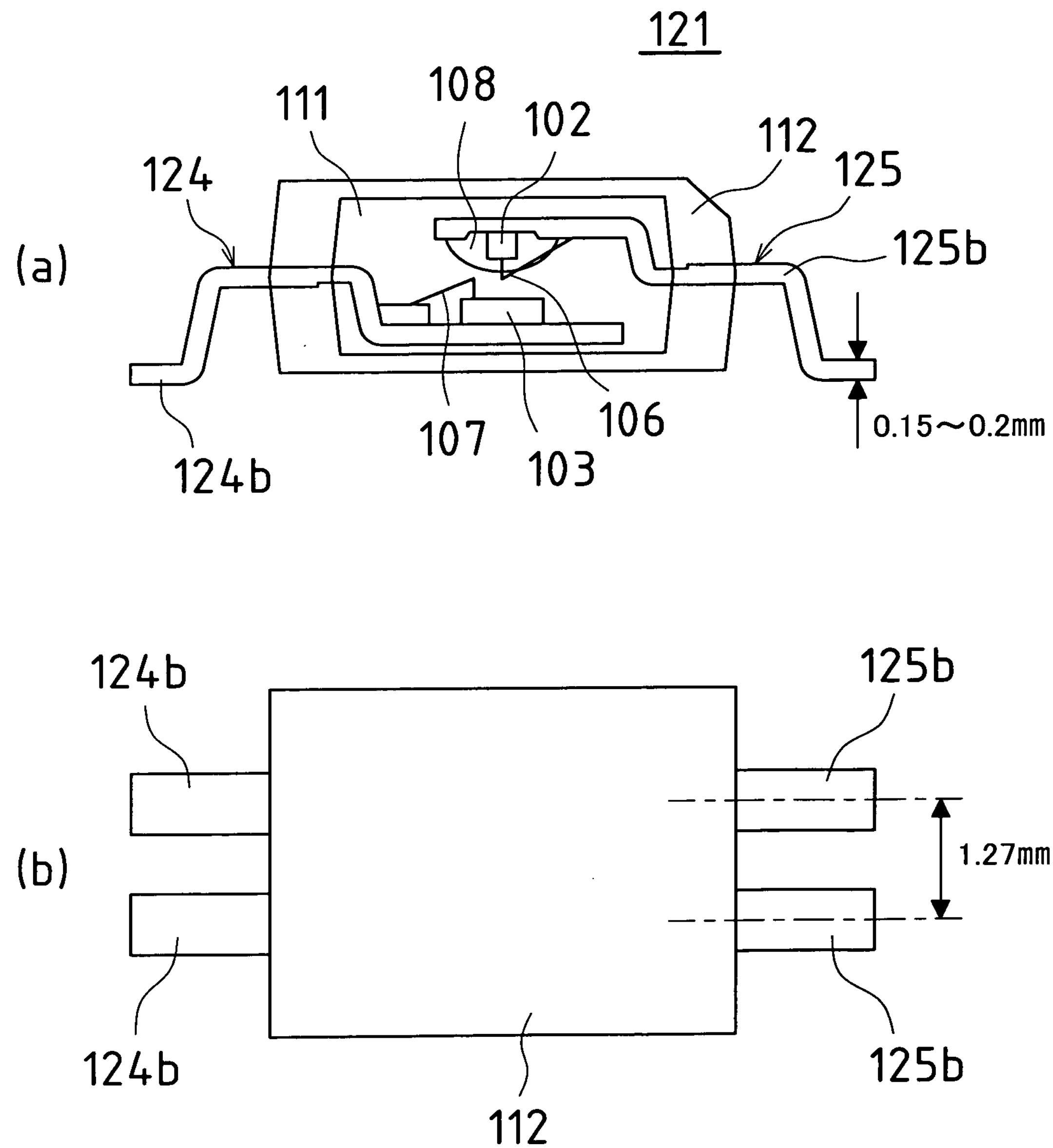
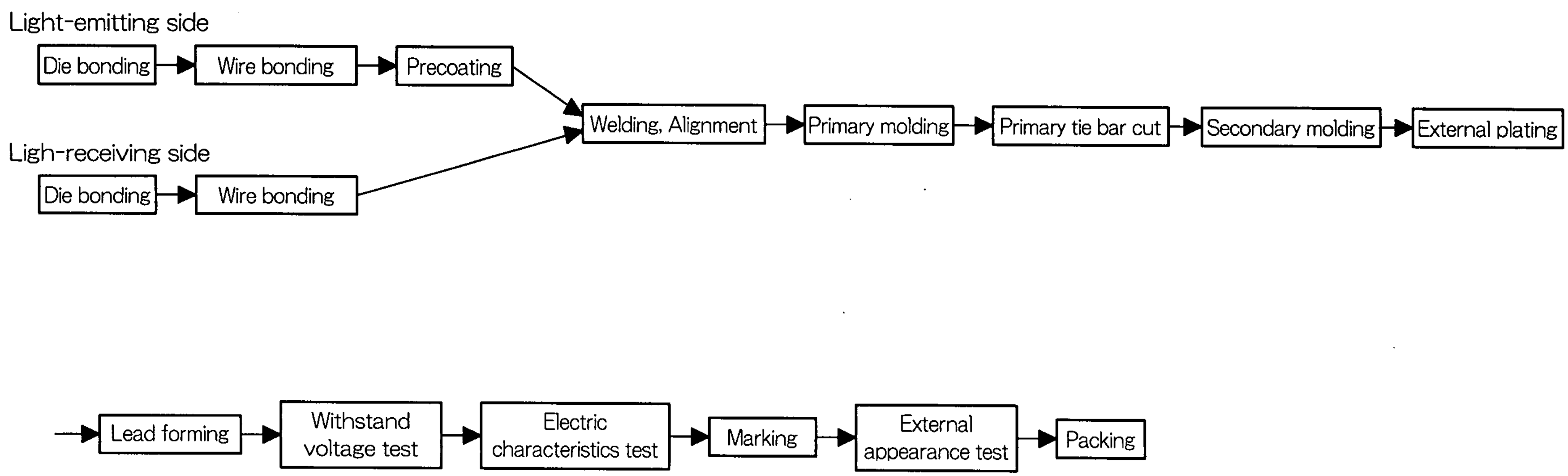

121
111
108
102
112
124
125
(a)
125b
0.15～0.2mm
124b
107
103
106
124b
125b
(b)
1.27mm
124b
125b
112

Fig.8



Light-emitting side
Die bonding
Wire bonding
Precoating
Ligh-receiving side
Die bonding
Wire bonding
Welding, Alignment
Primary molding
Primary tie bar cut
Secondary molding
External plating
Lead forming
Withstand voltage test
Electric characteristics test
Marking
External appearance test
Packing